

What is claimed:

1. A process for treating iron-containing waste streams in which an iron-containing compound is produced from a liquid slurry stream, said process comprises the steps of:
 - a. adding an initial neutralization agent to a liquid slurry stream to form a first precipitate and a first liquid phase, wherein said liquid slurry stream comprises iron (II) chloride;
 - b. combining said first liquid phase and a sulfate-containing compound to form a second precipitate and a second liquid phase, wherein said second precipitate comprises gypsum and said second liquid phase comprises iron (II) chloride;
 - c. separating said second precipitate from said second liquid phase; and
 - d. subjecting said second liquid phase to an oxidation, neutralization and precipitation process to form an iron-containing compound and a residual liquid phase.
2. The process according to claim 1, wherein said liquid slurry stream is formed by chlorinating an iron-containing substance.
3. The process according to claim 2, further comprising chlorinating a titanium-containing substance.

4. The process according to claim 1, wherein said liquid slurry stream further comprises at least one metal chloride selected from the group consisting of chlorides and oxychlorides of manganese, chromium, vanadium, aluminum, niobium, magnesium, calcium, silicon and zirconium.
5. The process according to claim 1, wherein said initial neutralization agent is a calcium-containing neutralization agent.
6. The process according to claim 5, wherein said initial neutralization agent is selected from the group consisting of calcium hydroxide, calcium oxide, calcium carbonate and mixtures thereof.
7. The process according to claim 1, wherein said adding of said initial neutralization agent changes the pH of the liquid slurry stream to a pH between about pH 4.0 and about pH 4.5.
8. The process according to claim 1, wherein said first precipitate is not separated from said first liquid phase prior to step (b).
9. The process according to claim 1, wherein said first precipitate is separated from said first liquid phase prior to the combining of the first liquid phase with the sulfate-containing compound.
10. The process according to claim 1, wherein said sulfate-containing compound is selected from the group consisting of ammonium sulfate, iron sulfate, sodium sulfate and mixtures thereof.

11. The process according to claim 1, wherein said iron-containing compound is selected from the group consisting of α -FeO(OH), β -FeO(OH), γ -FeO(OH) and combinations thereof.
12. The process according to claim 1 further comprising isolating a manganese-containing compound from said residual liquid phase.
13. The process according to claim 12, wherein said step of isolating comprises adding sodium carbonate or ammonium carbonate to said residual liquid phase.
14. A process for treating iron-containing waste streams in which an iron-containing compound is produced from a liquid slurry stream, said process comprises the steps of:
- a. dividing a liquid slurry stream into a first slurry stream and a second slurry stream, wherein said liquid slurry stream comprises iron (II) chloride;
 - b. adding a calcium-containing neutralization agent to said first slurry stream to form a metal hydroxide-containing precipitate and a calcium chloride-containing liquid phase;
 - c. separating a majority of said calcium chloride-containing liquid phase from the metal hydroxide-containing precipitate and a minority of said calcium chloride-containing liquid phase;
 - d. adding said metal hydroxide-containing precipitate and said minority of said calcium chloride-containing liquid phase to said second slurry stream to form a first precipitate and a first liquid phase;

- e. separating said first precipitate from said first liquid phase; and
- f. subjecting said first liquid phase to an oxidation, neutralization and precipitation process to form an iron-containing compound and a residual liquid phase.

15. The process according to claim 14, wherein a sulfate-containing compound is added after the formation of the metal hydroxide-containing precipitate but prior to step (c) to form gypsum.
16. A process for treating iron-containing waste streams, said process comprising
- a. combining the first liquid phase of claim 14 and a sulfate-containing compound to form a second precipitate and a second liquid phase, wherein said second liquid phase comprises iron (II) chloride and said second precipitate comprises gypsum;
 - b. separating said second precipitate from said second liquid phase; and
 - c. subjecting said second liquid phase to an oxidation, neutralization and precipitation process to form an iron-containing compound.
17. The process according to claim 16, wherein said sulfate-containing compound is added to said first liquid phase after the separation of said first liquid phase from said first precipitate to form gypsum.
18. The process according to claim 14, wherein said metal hydroxide-containing precipitate is capable of precipitating in an environment of from about pH 7 to about pH 9.

19. The process according to claim 14, wherein said liquid slurry stream is formed by chlorinating an iron-containing substance.
20. The process according to claim 14, further comprising chlorinating a titanium-containing substance.
21. The process according to claim 14, wherein said liquid slurry stream further comprises at least one metal chloride selected from the group consisting of chlorides and oxychlorides of manganese, chromium, vanadium, aluminum, niobium, magnesium, calcium, silicon and zirconium.
22. The process according to claim 14, wherein said calcium-containing neutralization agent is selected from the group consisting of calcium hydroxide, calcium oxide, calcium carbonate and mixtures thereof.
23. The process according to claim 14, wherein said adding of said calcium-containing neutralization agent changes the pH of the liquid slurry to a pH between about pH 4.0 and about pH 4.5.
24. The process according to claim 14, wherein from about 50% to about 80% of the iron (II) chloride present in step (c) is oxidized, neutralized and precipitated to form said iron-containing compound.
25. The process according to claim 14, wherein said iron-containing compound is selected from the group consisting of α -FeO(OH), β -FeO(OH), γ -FeO(OH) and combinations thereof.

26. The process according to claim 14, further comprising isolating a manganese-containing compound from said residual liquid.
27. The process according to claim 26, wherein said step of isolating comprises adding sodium carbonate or ammonium carbonate to said residual liquid phase.
28. A process for treating an iron-containing waste stream, said process comprises the steps of:
- a. adding an initial neutralization agent to a liquid slurry stream to form a first precipitate and a first liquid phase, wherein said liquid slurry stream comprises an iron (II) chloride;
 - b. dividing said first liquid phase into a first solution and a second solution;
 - c. adding a calcium-containing neutralization agent to said first solution to form a metal hydroxide-containing precipitate and a calcium chloride-containing liquid phase;
 - d. using said metal hydroxide-containing precipitate and a minority of said calcium-chloride containing liquid phase as said initial neutralization agent; and
 - e. subjecting said second solution to an oxidation, neutralization and precipitation process to form an iron-containing compound and a residual phase.

29. A process for treating an iron-containing waste stream according to claim 28, further comprising adding a sulfate-containing compound prior to step (b) to form gypsum.
- 5 30. A process for treating an iron-containing waste stream according to claim 28, further comprising adding a sulfate-containing compound after step (b).
31. A process for producing an iron-containing compound from a liquid slurry stream that comprises:
- a. combining said second solution of claim 28 with a sulfate-containing compound to form a second precipitate and a second liquid phase, wherein said second liquid phase comprises iron (II) chloride and said second precipitate comprises gypsum;
 - b. separating said second precipitate from said second liquid phase; and
 - c. subjecting said second liquid phase to an oxidation, neutralization and precipitation process to form an iron-containing compound and a residual liquid phase.
- 20 32. A process for treating an iron-containing waste stream according to claim 28, further comprising adding a sulfate-containing compound after step (c).
- 25 33. The process according to claim 28, wherein said metal hydroxide-containing precipitate is capable of precipitating in an environment of from about pH 7 to about pH 9.

34. The process according to claim 28, wherein said liquid slurry stream is formed by chlorinating an iron-containing substance.
35. The process according to claim 28, further comprising chlorinating a titanium-containing substance.
36. The process according to claim 28, wherein said liquid slurry stream further comprises at least one metal chloride selected from the group consisting of chlorides and oxychlorides of manganese, chromium, vanadium, aluminum, niobium, magnesium, calcium, silicon and zirconium, uranium, thorium and tin.
37. The process according to claim 28, wherein said calcium-containing neutralization agent is selected from the group consisting of calcium hydroxide, calcium oxide, calcium carbonate and mixtures thereof.
38. The process according to claim 28, wherein said adding of said initial neutralization agent changes the pH of the liquid slurry to a pH between about pH 4.0 and about pH 4.5.
39. The process according to claim 28, wherein said iron-containing compound is selected from the group consisting of α -FeO(OH), β -FeO(OH), γ -FeO(OH) and combinations thereof.
40. The process according to claim 28, further comprising isolating a manganese-containing compound from said residual liquid.

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41. The process according to claim 28, wherein said step of isolating comprises adding sodium carbonate or ammonium carbonate to said residual liquid phase.
42. In the process of forming γ -FeO(OH) by precipitation, wherein the improvement comprises using sodium carbonate.